Spectral Transmission Measurements on various Astronomical Filters.

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Thanks to my friend Olivier, who provided the Spectrometer, I was able to do some spectral transmission measurements with my collection of filters.
I used a StellarNet EPP2000-vis Spectrometer (grating with 600g/mm) with a StellarNet Halogen light source.
The Spectrawiz Software that comes with this Spectrometer allows direct transmission measurement by subtracting the light source spectrum.
This transmission data was then saved in text format and processed with MS Excel.
I selected the measurement range from 420nm to 900nm since this is a more than sufficient range for imaging.

1. Reference Lasers

At first I checked the calibration of the spectrometer by using reference wavelengths emitted by lasers. I used a green 532nm and a red 658nm diode laser.

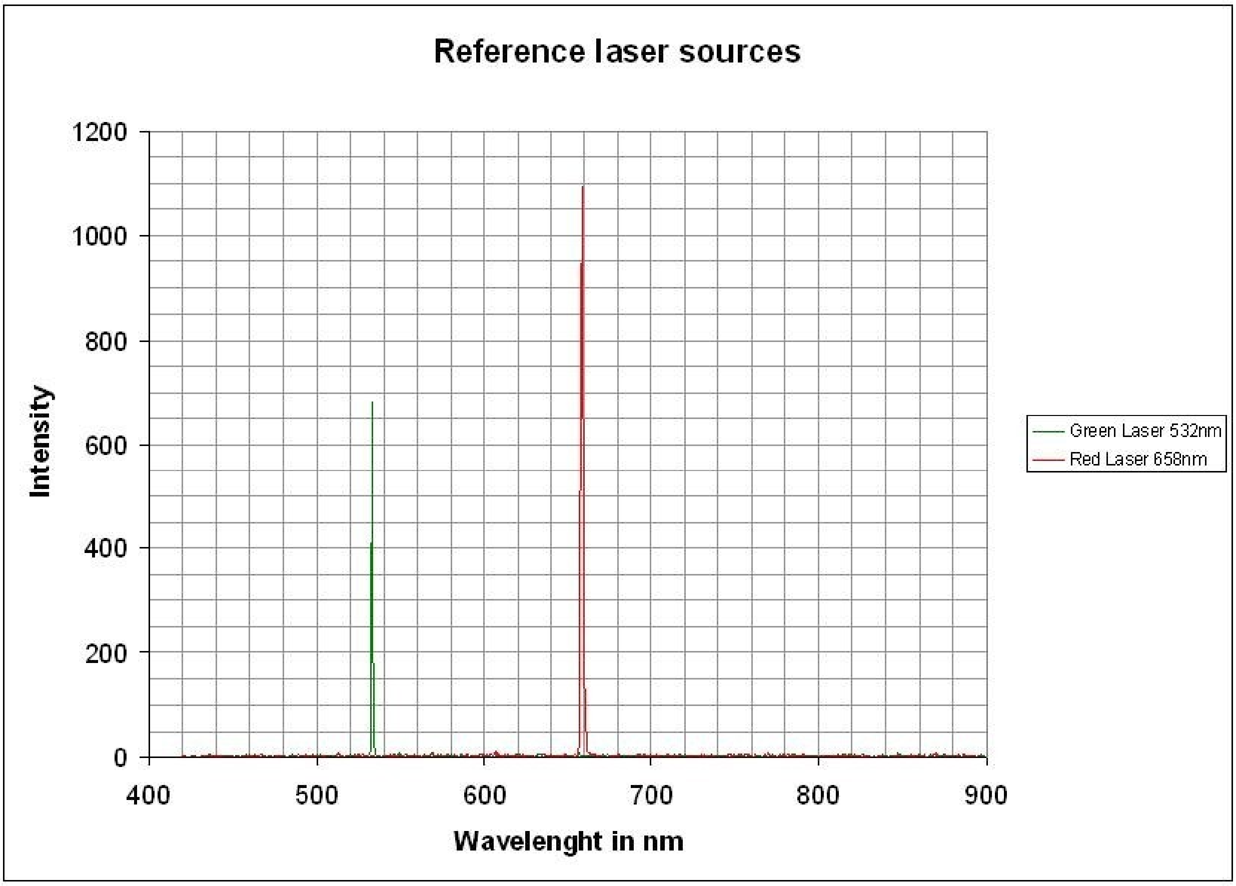

Figure1: Reference Lasers

The centroids calculated by the Spectrawiz SW were 533.44nm for the green and 658.69nm for the red laser. The calibration of this instrument seems to be fine, since we have only deviations of 1.44nm for green and 0.69nm for red.

2. Baader Narrowband H-alpha 7nm

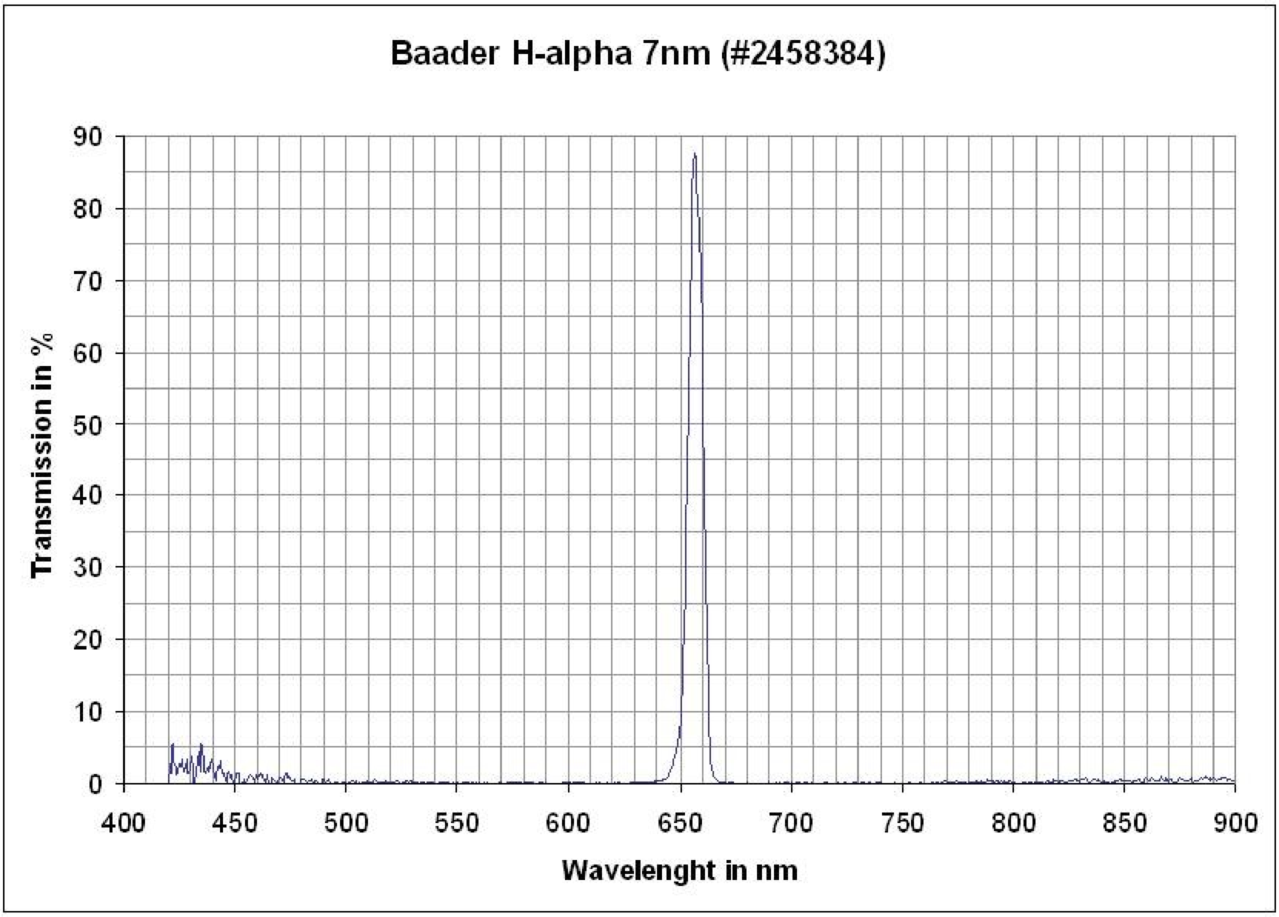

Figure 2: 2" Baader H-alpha 7nm

The purpose of this filter is eliminating all light except the wavelength of the Hydrogen Alpha Balmer Line at 656.3nm.
The graph shows a nearly perfect behaviour of this filter with a single transmission peak of 87% at 656.6nm. The calculated FWHM is 7.61nm and very close to the promised 7nm.
All other wavelengths in the range from 420nm to 900nm are blocked. Together with the ACF Filter in my camera, I can be sure, that only the desired wavelength hits the sensor by using this filter.

3. Baader O-III Narrowband Filter

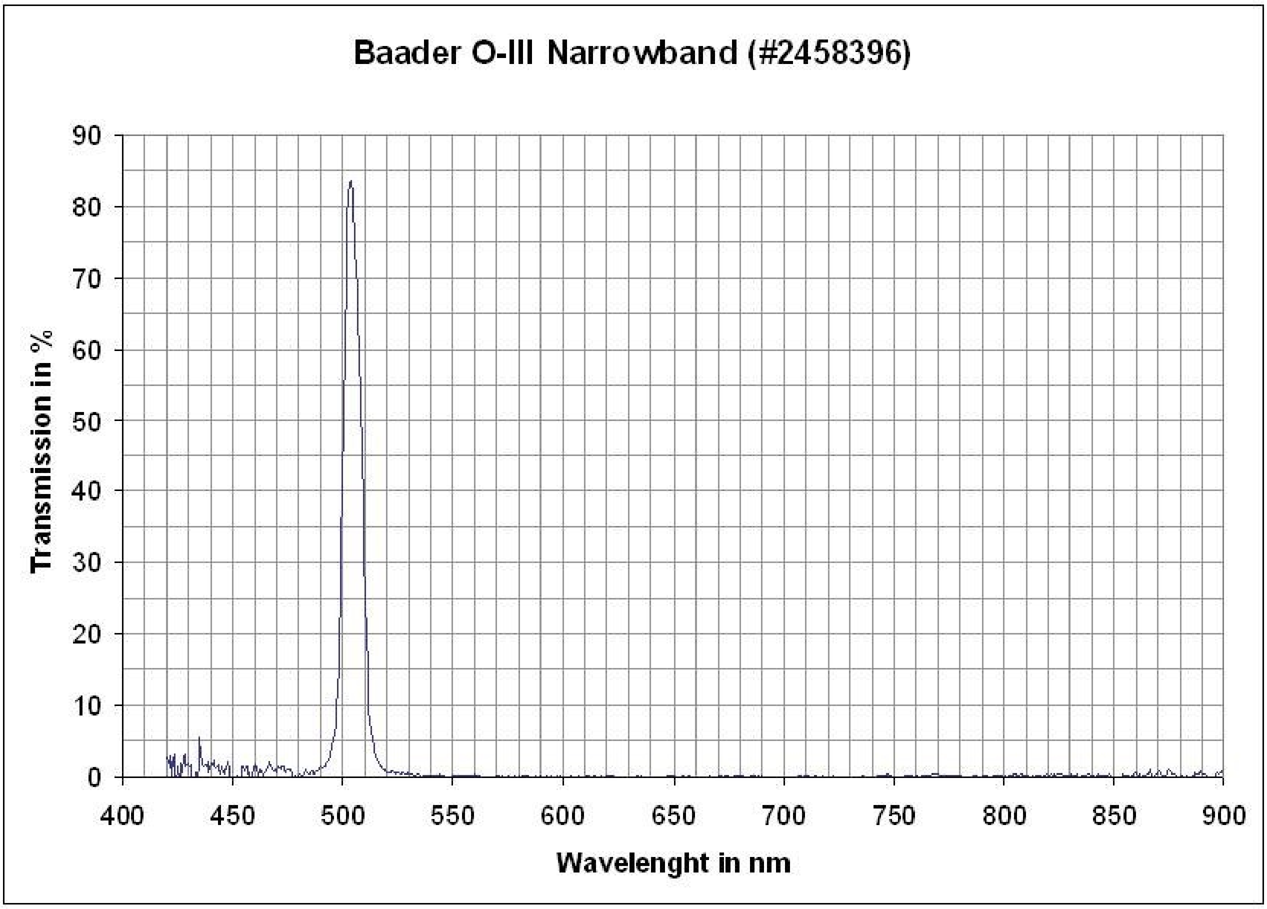

Figure 3: 2” Baader O-III

This is another narrowband filter with a desired transmission at 500.7nm (Oxygen 3 Emission Line).
The transmission peak is at 503.5nm with 84% and a FWHM of 9.00nm. If we assume, that our Spectrometer is accurate, the Transmission at 500.7nm is only about 55%. That would decrease the performance of this filter dramatically! If we look at our reference laser spectrum, we see that the measured wavelength of the green laser was 1.44nm to high.
If we assume now, that we have an offset of approx. 1.5nm and the real peak is at 502nm, we get a transmission at 500.7nm of about 80% - much better!
The very effective block of all other wavelengths is similar to the H-alpha filter.

4. Baader UHC-S Nebula Filter

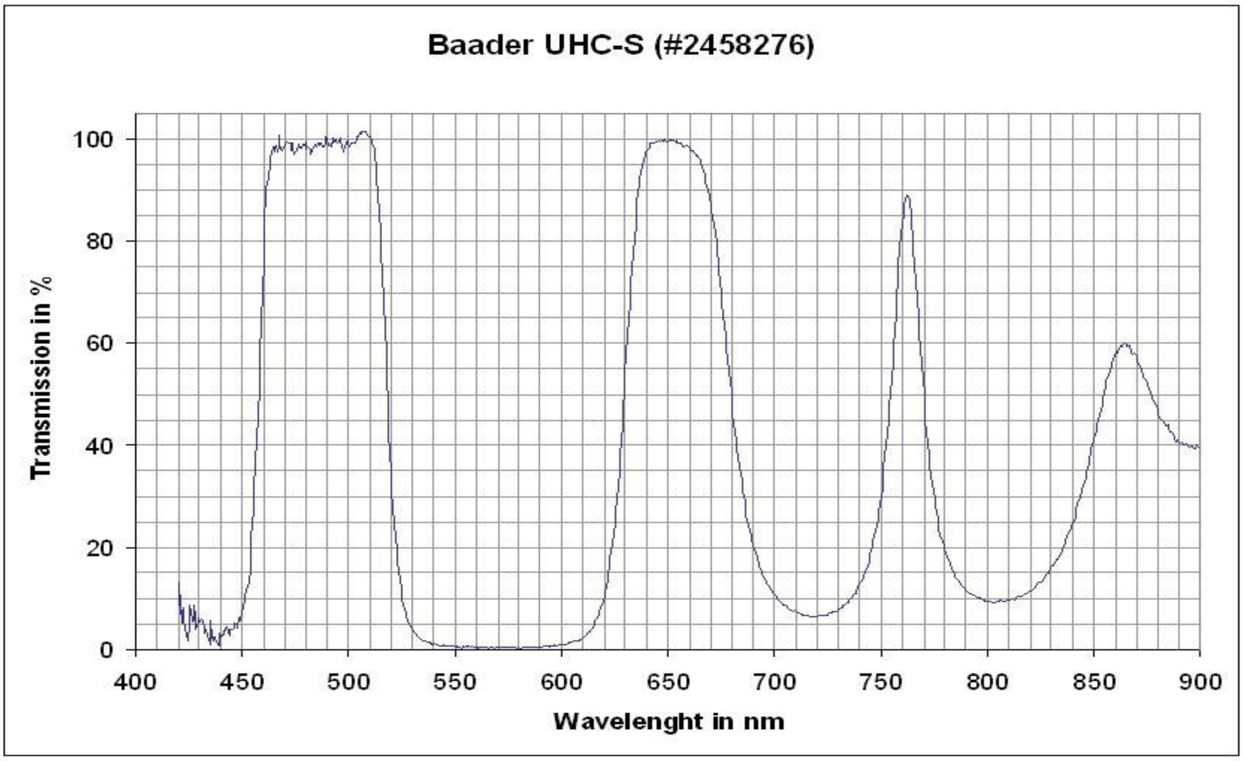

Figure 4: 2" Baader UHC-S

This filter is designed for contrast increase of nebulas. The transmission peaks are much wider than the ones from the Narrowband filters. However, the interesting Wavelengths of H-alpha, H-beta and O-III are all transmitted with nearly 100%.

The range from 530nm to 620nm is completely blocked. This is the wavelength range of this typical orange sky glow in light polluted areas. Below you can see an Emission spectrum of a typical street light, that helps to understand why our sky turns orange.

I have used this filter extensively for imaging and it helps me a lot, since my imaging site suffers from significant light pollution.

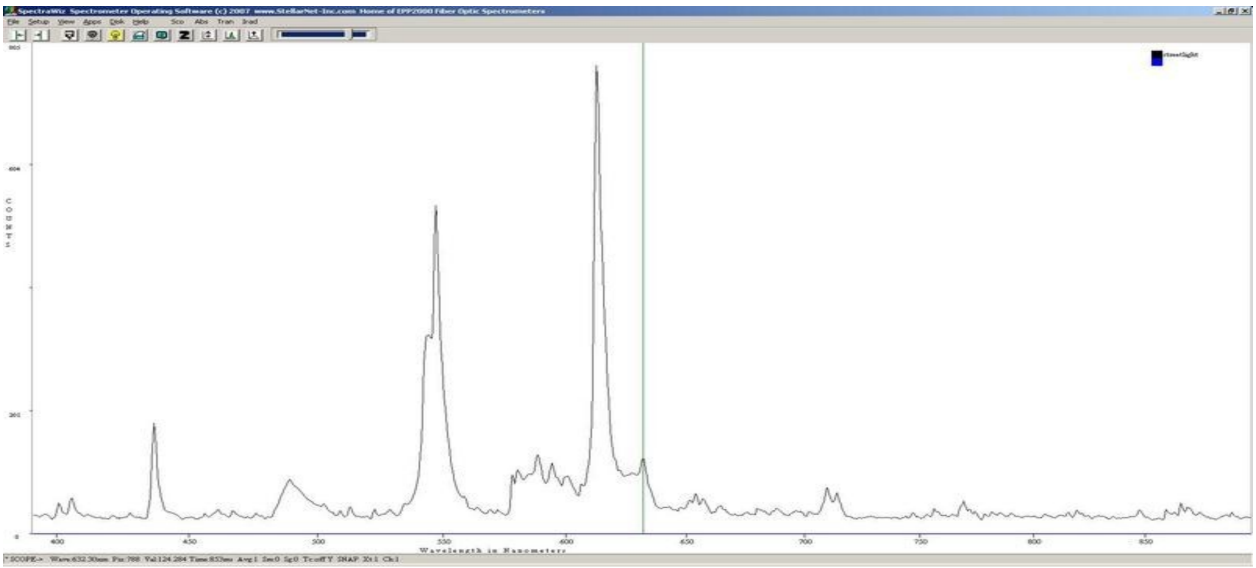

Figure 5: Street light emission

5. Baader Moon & Skyglow Filter

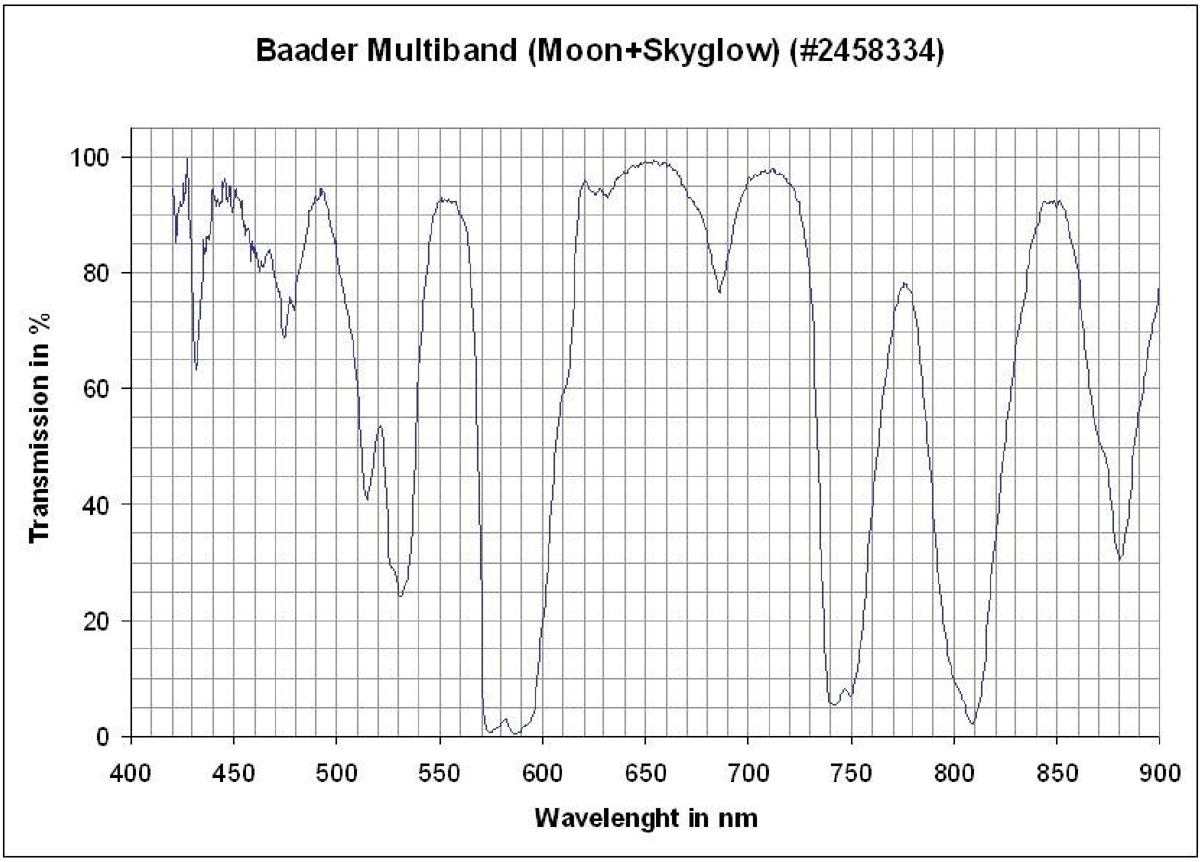

Figure 6: 2" Baader Moon+Skyglow

This Multiband filter features a Neodymium coating and is used to improve the contrast of different celestial objects, as well as skyglow suppression.

Looking at the graph reveals that this filter does not perform like the previous ones, with their clearly defined High- and Low- Transmission areas. The explanation is that this coating is not designed, it was more or less "discovered".

The simple coating explains the relative low price of this filter.

Since it cuts out some orange, it may be useful in suppressing sky glow, but the peaks of our streetlight spectrum are passing through. I could not try this filter yet, but I will do so soon and add some comments here...

6. Baader UV/IR-Rejection Filter

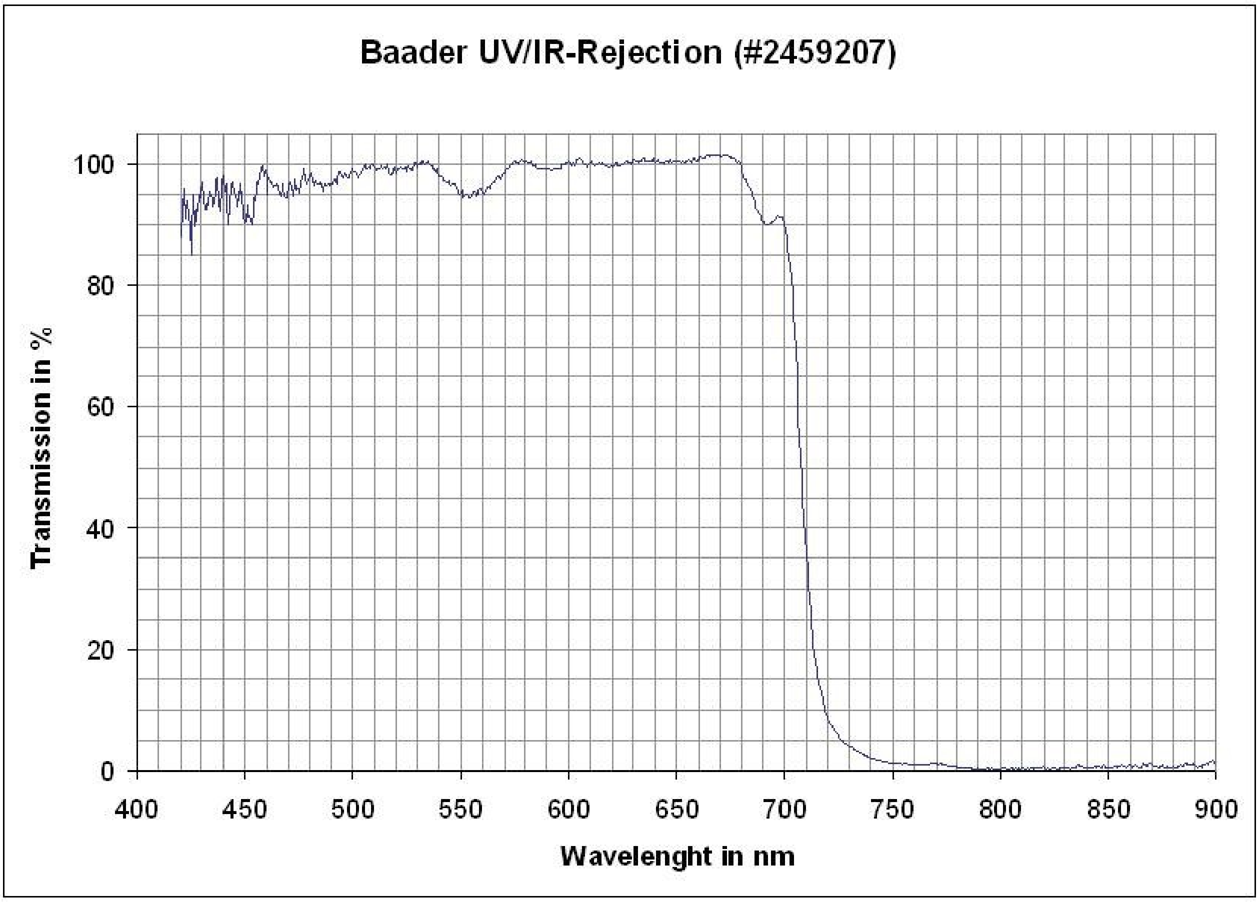

Figure 7: 1.25” Baader UV/IR rejection

This is a relative simple filter that cuts off infrared and ultraviolet light, while transmitting the rest with nearly 100%.
It performs very well with a transmission above 90% in the whole visible range and a well defined transmission drop to nearly 0% at >700nm.
Filters like that, are used for CCD imaging with refractor telescopes. Without IR filter the recorded image would look blurred since the IR light is not in focus with the visible light, but still detected by the CCD.
I use this filter for webcam imaging.

7. Meade CCD Interference IR

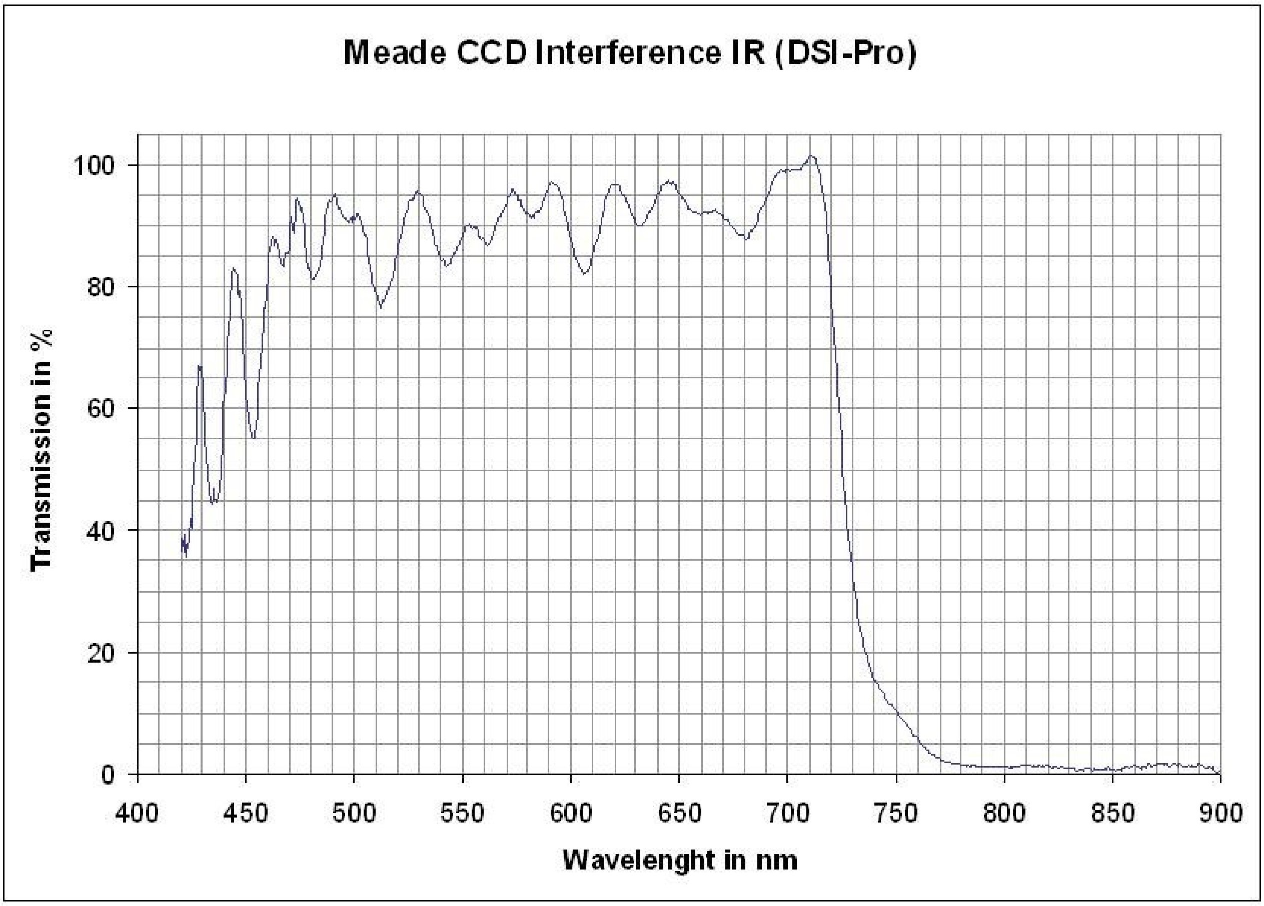

Figure 8: 1.25" Meade IR-cut

The purpose of this filter is exactly the same like the previous one. It is a filter that comes with the Meade DSI-Pro Filter set.
The graph reveals the not optimal spectral filtering with the transmission dropping well below 90% in the visible range.
It is a good example why I prefer Baader Filter!

8. Meade CCD Interference RGB Filters

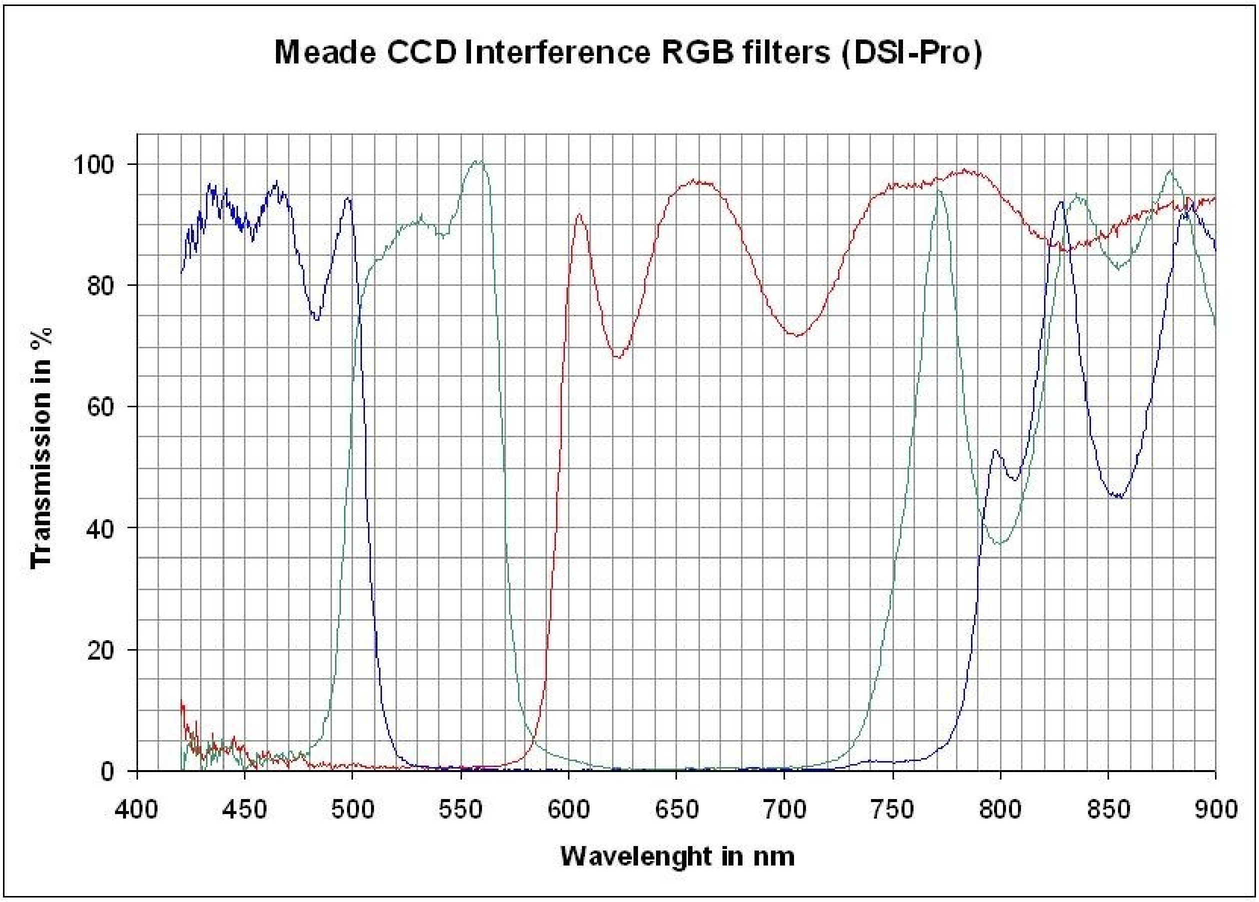

Figure 9: 1.25" Meade RGB set

These filters come with the Meade DSI-Pro monochrome CCD camera for RGB imaging.
I have put the transmission spectra of all 3 filters (red, green, blue) in one diagram, each graph with its respective colour.
Ideally, we would see for each filter a 100% transmission in its specified wavelength (colour) range and a 0% transmission for the rest.
The Meade filters are far from being perfect. The transmission is fluctuating and generally low. The transmission ranges are overlapping from green to blue and leaving a gap from green to red.
It is interesting, that this transmission gap is in the same wavelength range like the main gap of the Neodymium filter. Maybe Meade wants to implement some sort of sky glow filter by that?